

WE CLAIM:

1. A system for washing, disinfecting, or sterilizing an object, the system
5 comprising:

first station adapted and configured to house the object;

sonicator adapted and configured to impact the object in the first station with
ultrasonic energy;

liquid transporter adapted and configured to circulate at the first station and around
10 the object wash composition, antimicrobial composition, rinse composition, or to circulate a
plurality of these compositions; and

dryer adapted and configured to dry the object.

2. The system of claim 1, wherein the sonicator is adapted and configured to
15 provide ultrasonic energy from a point at the first station.

3. The system of claim 2, further comprising holder at the first station, the holder
being adapted and configured for supporting the object, and

wherein the sonicator comprises ultrasonic probe at the first station and adjacent
20 position taken by the object in the holder.

4. The system of claim 2, wherein the sonicator comprises irrigated probe.

5. The system of claim 1, wherein the sonicator is adapted and configured to
25 provide ultrasonic energy throughout fluid at the first station.

6. The system of claim 5, further comprising second sonicator adapted and
configured to provide ultrasonic energy from probe outside the first station.

7. The system of claim 6, wherein the second sonicator comprises irrigated
30 probe.

8. The system of claim 6, further comprising holder adapted and configured to support the object adjacent the second sonicator probe.

9. The system of claim 1, wherein the sonicator is adapted and configured to dislodge soil from the object and the liquid transporter is adapted and configured to remove the soil.

10. The system of claim 1, wherein the liquid transporter comprises pump and valve adapted and configured to circulate fluid at the first station and around the object, to add fluid to the first station, and to remove fluid from the first station.

11. The system of claim 1, wherein the first station, the sonicator, and the liquid transporter are adapted and configured to immerse the object in the wash composition and apply ultrasonic energy to the immersed object.

12. The system of claim 11, wherein the sonicator is adapted and configured to provide ultrasonic energy from point within the first station.

13. The system of claim 11, wherein the sonicator comprises irrigated probe.

14. The system of claim 11, wherein the sonicator applies ultrasonic energy throughout the wash composition.

15. The system of claim 11, wherein the first station comprises tub, tank, or bath.

16. The system of claim 1, wherein the first station and the liquid transporter are adapted and configured to immerse the object in the antimicrobial composition, the rinse composition, or a plurality of these compositions.

17. The system of claim 16, wherein the first station comprises tub, tank, or bath.

18. The system of claim 1, wherein the liquid transporter comprises sprayer adapted and configured to apply to the object the antimicrobial composition, the rinse composition, or a plurality of these compositions.

5 19. The system of claim 18, wherein the first station comprises spray chamber.

20. The system of claim 1, wherein the liquid transporter is adapted and configured to sequentially circulate the wash composition, the antimicrobial composition, and the rinse composition.

10 21. The system of claim 1, wherein the liquid transporter is adapted and configured to circulate the wash composition, the antimicrobial composition, first rinse composition, second rinse composition, or to circulate a plurality of these compositions.

15 22. The system of claim 21, wherein the liquid transporter is adapted and configured to sequentially circulate, in this order, the wash composition, the first rinse composition, the antimicrobial composition, and the second rinse composition.

20 23. The system of claim 1, further comprising dispenser adapted and configured to add wash concentrate, antimicrobial concentrate, rinse concentrate, or to add a plurality of these concentrates.

24. The system of claim 1, wherein the dryer is adapted and configured to dry the object at the first station.

25 25. The system of claim 1, wherein the dryer comprises blower adapted and configured to circulate heated gas at the first station.

30 26. The system of claim 1, further comprising injector adapted and configured to add sterilant at the first station.

27. The system of claim 26, wherein the injector comprises pressure release valve adapted and configured to release at the first station gaseous sterilant from pressurized vessel.

28. The system of claim 26, further comprising vent adapted and configured to
5 evacuate sterilant gas from the first station.

29. The system of claim 1, further comprising conveyor adapted and configured to transport the object through the system.

30. The system of claim 1, further comprising emitter adapted and configured to
10 impact the object with microwave or light energy.

31. The system of claim 1, further comprising second station, wherein:
the first station comprises the sonicator and is adapted and configured to circulate at
15 the first station and around the object the wash composition, the antimicrobial composition, the rinse composition, or a plurality of these compositions; and
the second station is adapted and configured to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; the second station comprises the dryer; or a combination thereof.

32. The system of claim 31, wherein the liquid transport system comprises sprayer
20 at the second station and adapted and configured to apply to the object the antimicrobial composition, the rinse composition, or a plurality of these compositions.

33. The system of claim 32, wherein the second station comprises spray chamber.

34. The system of claim 31, wherein the second station and the liquid transporter
are adapted and configured to immerse the object in the antimicrobial composition, the rinse
composition, or a plurality of these compositions.

35. The system of claim 34, wherein the second station comprises tub, tank, or bath.

36. The system of claim 31, wherein the second station is adapted and configured to circulate around the object the rinse composition.

37. The system of claim 36, wherein the first station is adapted and configured to circulate around the object the wash composition, the antimicrobial composition, and first rinse composition; and the second station is adapted and configured to circulate around the object second rinse composition.

38. The system of claim 31, wherein the second station is adapted and configured to circulate around the object the antimicrobial composition and the rinse composition.

39. The system of claim 38, wherein the first station is adapted and configured to circulate around the object the wash composition and first rinse composition; and the second station is adapted and configured to circulate around the object the antimicrobial composition and second rinse composition.

40. The system of claim 31, wherein the second station comprises the dryer.

41. The system of claim 31, further comprising injector adapted and configured to add sterilant at the second station.

42. The system of claim 31, further comprising third station, wherein:
the first station comprises the sonicator and is adapted and configured to circulate at the first station and around the object the wash composition, the antimicrobial composition, or a plurality of these compositions;

the second station is adapted and configured to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and

the third station is adapted and configured to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; the third station comprises the dryer; or a combination thereof.

5 43. The system of claim 42, wherein the third station comprises the dryer.

44. The system of claim 43, further comprising injector adapted and configured to add sterilant at the third station.

10 45. The system of claim 42, wherein the third station is adapted and configured to circulate around the object the rinse composition.

15 46. The system of claim 45, wherein the liquid transport system comprises sprayer at the third station and adapted and configured to apply the rinse composition to the object.

47. The system of claim 46, wherein the third station comprises spray chamber.

20 48. The system of claim 45, wherein the third station and the liquid transporter are adapted and configured to immerse the object in the rinse composition.

49. The system of claim 48, wherein the third station comprises tub, tank, or bath.

50. The system of claim 42, wherein:

25 the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition, first rinse composition and the antimicrobial composition; and

 the second station is adapted and configured to circulate around the object second rinse composition.

30 51. The system of claim 42, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition and first rinse composition; and

the second station is adapted and configured to circulate around the object the antimicrobial composition and second rinse composition.

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52. The system of claim 42, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition; and

10 the second station is adapted and configured to circulate around the object first rinse composition, the antimicrobial composition, and second rinse composition.

53. The system of claim 42, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition and first rinse composition;

15 the second station is adapted and configured to circulate around the object the antimicrobial composition; and

the third station is adapted and configured to circulate around the object second rinse composition.

20 54. The system of claim 42, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition;

the second station is adapted and configured to circulate around the object first rinse composition and the antimicrobial composition; and

25 the third station is adapted and configured to circulate around the object second rinse composition.

55. The system of claim 42, further comprising fourth station, wherein:

30 the first station comprises the sonicator and is adapted and configured to circulate at the first station and around the object the wash composition, the antimicrobial composition, or a plurality of these compositions;

the second station is adapted and configured to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

the third station is adapted and configured to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and

the fourth station is adapted and configured to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; the fourth station comprises the dryer; or a combination thereof.

56. The system of claim 55, wherein the fourth station comprises the dryer.

57. The system of claim 56, further comprising injector adapted and configured to add sterilant at the fourth station.

58. The system of claim 55, wherein the fourth station is adapted and configured to circulate around the object the rinse composition.

59. The system of claim 58, wherein the liquid transport system comprises sprayer in the fourth station and adapted and configured to apply the rinse composition to the object.

60. The system of claim 59, wherein the fourth station comprises spray chamber.

61. The system of claim 58, wherein the fourth station and the liquid transporter are adapted and configured to immerse the object in the rinse composition.

62. The system of claim 61, wherein the fourth station comprises tub, tank, or bath.

63. The system of claim 55, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition;

the second station is adapted and configured to circulate around the object the antimicrobial composition and first rinse composition; and

5 the third station is adapted and configured to circulate around the object second rinse composition.

64. The system of claim 55, wherein:

10 the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition and first rinse composition;

the second station is adapted and configured to circulate around the object the antimicrobial composition;

15 the third station is adapted and configured to circulate around the object second rinse composition.

65. The system of claim 55, wherein:

the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition;

20 the second station is adapted and configured to circulate around the object first rinse composition; and

the third station is adapted and configured to circulate around the object the antimicrobial composition and second rinse composition.

66. The system of claim 55, wherein:

25 the first station comprises the sonicator and is adapted and configured to circulate around the object the wash composition;

the second station is adapted and configured to circulate around the object first rinse composition;

30 the third station is adapted and configured to circulate around the object the antimicrobial composition; and

the fourth station is adapted and configured to circulate around the object second rinse composition and the fourth station comprises the dryer.

67. The system of claim 55, further comprising fifth station, wherein:

5 the first station comprises the sonicator and is adapted and configured to circulate at the first station and around the object the wash composition, the antimicrobial composition, or a plurality of these compositions;

10 the second station is adapted and configured to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

the third station is adapted and configured to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

15 the fourth station is adapted and configured to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

the fifth station is adapted and configured to circulate at the fifth station and around the object the rinse composition, the fifth station comprises the dryer, or a combination thereof.

20 68. The system of claim 67, wherein the fifth station comprises the dryer.

69. The system of claim 68, further comprising injector adapted and configured to add sterilant at the fifth station.

25 70. The system of claim 67, wherein the fifth station is adapted and configured to circulate around the object the rinse composition.

30 71. The system of claim 70, wherein the liquid transport system comprises sprayer in the fifth station and adapted and configured to apply the rinse composition to the object.

72. The system of claim 71, wherein the fifth station comprises spray chamber.

73. The system of claim 70, wherein the fifth station and the liquid transporter are adapted and configured to immerse the object in the rinse composition.

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74. The system of claim 73, wherein the fifth station comprises tub, tank, or bath.

75. The system of claim 67, wherein:

10 the first station comprises the sonicator and is adapted and configured to circulate the wash composition;

the second station is adapted and configured to circulate first rinse composition;

the third station is adapted and configured to circulate the antimicrobial composition;

and

the fourth station is adapted and configured to circulate second rinse composition.

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76. The system of claim 67, further comprising sixth station, wherein:

the first station comprises the sonicator and is adapted and configured to circulate at the first station and around the object the wash composition, the antimicrobial composition, or a plurality of these compositions;

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the second station is adapted and configured to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

the third station is adapted and configured to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or a plurality of these

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compositions;

the fourth station is adapted and configured to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

the fifth station is adapted and configured to circulate at the fifth station and around the object the rinse composition, the fifth station comprises the dryer, the fifth station comprises the apparatus to add gaseous sterilant, or a combination thereof; and

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the sixth station comprises the dryer, the sixth station comprises the apparatus to add gaseous sterilant, or a combination thereof.

77. A system for washing, disinfecting, or sterilizing an object, the system comprising:

sonicator adapted and configured to impact the object with ultrasonic energy;
liquid transporter adapted and configured to circulate around the object wash composition, antimicrobial composition, and rinse composition; and
dryer adapted and configured to dry the object in the presence of sterilant.

78. A system for washing, disinfecting, or sterilizing object, the system comprising:

first station and second station;
sonicator adapted and configured to impact the object in the first station with ultrasonic energy;
liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or plurality of these compositions; and
dryer adapted and configured to dry the object in the second station in the presence of sterilant.

79. A system for washing, disinfecting, or sterilizing an object, the system comprising:

first station, second station, and third station;
sonicator adapted and configured to impact the object in the first station with ultrasonic energy;
liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or a plurality of these compositions; and to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and

dryer adapted and configured to dry the object in the third station in the presence of sterilant.

80. A system for washing, disinfecting, or sterilizing an object, the system comprising:

first station, second station, third station, and fourth station;

sonicator adapted and configured to impact the object in the first station with ultrasonic energy;

liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or a plurality of these compositions; to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and

dryer adapted and configured to dry the object in the fourth station in the presence of sterilant.

81. A system for washing, disinfecting, or sterilizing an object, the system comprising:

first station, second station, third station, fourth station, and fifth station;

sonicator adapted and configured to impact the object in the first station with ultrasonic energy;

liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or plurality of these compositions; to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; and to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions; and

dryer adapted and configured to dry the object at the fifth station in the presence of sterilant.

82. A system for washing, disinfecting, or sterilizing an object, the system comprising:

first station, second station, third station, fourth station, fifth station, and sixth station;

sonicator adapted and configured to impact the object in the first station with ultrasonic energy;

liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or plurality of these compositions; to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; and to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

dryer adapted and configured to dry the object at the fifth station; and

apparatus adapted and configured to add to the sixth station gaseous sterilant.

83. A system for washing, disinfecting, or sterilizing an object, the system comprising:

first station, second station, third station, fourth station, fifth station, and sixth station;

sonicator adapted and configured to impact the object in the first station with ultrasonic energy;

liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or plurality of these compositions; to circulate at the second station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; to circulate at the third station and around the object the antimicrobial composition, the rinse composition, or plurality of these compositions; and to circulate at the fourth station and around the object the antimicrobial composition, the rinse composition, or a plurality of these compositions;

apparatus adapted and configured to add to the fifth station gaseous sterilant; and

dryer adapted and configured to dry the object at the sixth station.

84. A system for washing, disinfecting, or sterilizing an object, the system comprising:

emitter adapted and configured to impact the object with energy;

liquid transporter adapted and configured to circulate around the object wash

composition, antimicrobial composition, and rinse composition; and

dryer adapted and configured to dry the object in the presence of sterilant.

85. The system of claim 84, wherein the emitter comprises source of ultraviolet light adapted and configured to impact the object with ultraviolet light.

86. The system of claim 84, wherein the emitter comprises source of microwave energy adapted and configured to impact the object with microwave energy.

87. The system of claim 84, wherein the emitter and the liquid transporter are adapted and configured to impact the object with energy during or after circulating antimicrobial agent.

88. The system of claim 84, wherein the emitter and the dryer are adapted and configured to impact the object with energy before, during, or after operation of the dryer.

89. A method for washing, disinfecting, or sterilizing an object, the method comprising:

contacting the object with wash composition and ultrasonic energy;

treating the object with antimicrobial composition;

rinsing the object with rinse composition;

drying the object; and

exposing the object to gaseous sterilant.

90. The method of claim 89, wherein the wash composition comprises antimicrobial agent.

91. The method of claim 89, wherein the wash composition comprises solid carbonate cleaning composition.

92. The method of claim 89, wherein contacting the object with ultrasonic energy comprises providing ultrasonic energy from point source adjacent the object.

93. The method of claim 92, wherein contacting the object with ultrasonic energy comprises providing ultrasonic energy from irrigated probe adjacent the object.

94. The method of claim 89, wherein contacting the object with ultrasonic energy comprises applying ultrasonic energy throughout the wash composition.

95. The method of claim 89, wherein contacting the object with ultrasonic energy comprises providing ultrasonic energy from point source adjacent the object before contacting the object with the wash composition and applying ultrasonic energy throughout the wash composition.

96. The method of claim 95, wherein providing ultrasonic energy from point source adjacent the object comprises providing ultrasonic energy from irrigated probe adjacent the object.

97. The method of claim 89, wherein treating comprises treating with antimicrobial composition comprising peroxycarboxylic acid.

98. The method of claim 97, wherein the peroxycarboxylic acid comprises peroxyacetic acid, peroxyoctanoic acid, peroxyheptanoic acid, peroxy-nonanoic acid, or a combination thereof.

99. The method of claim 97, wherein treating comprises treating the object for sufficient time to achieve high level disinfection.

100. The method of claim 97, wherein treating comprises treating the object for sufficient time to achieve sterilization.

101. The method of claim 89, wherein treating comprises immersing the object in the antimicrobial composition, spraying the object with the antimicrobial composition, or a combination thereof.

102. The method of claim 89, wherein treating comprises impacting the object with microwave or light energy.

103. The method of claim 89, wherein the rinse composition comprises an alcohol drying agent, lubricant, rinse agent, or a combination thereof.

104. The method of claim 89, wherein rinsing comprises first rinsing after contacting and before treating, second rinsing after treating and before drying, or a combination thereof.

105. The method of claim 89, wherein rinsing comprises immersing the object in the rinse composition, spraying the object with the rinse composition, or a combination thereof.

106. The method of claim 89, wherein drying comprises circulating heated gas around the object.

107. The method of claim 89, wherein drying comprises exposing the object to gaseous sterilant.

108. The method of claim 89, wherein the gaseous sterilant comprises chlorine dioxide, ethylene oxide, or a combination thereof.

109. The method of claim 108, wherein drying comprises releasing the gaseous sterilant through pressure release valve from pressurized vessel.

5 110. The method of claim 108, wherein drying further comprises evacuating the gaseous sterilant from around the object.

111. The method of claim 89, wherein drying comprises impacting the object with microwave or light energy.

10 112. The method of claim 89, further comprising translocating the object between contacting and treating, between treating and rinsing, between rinsing and drying, or a combination thereof.

15 113. The method of claim 89, comprising carrying out contacting, treating, rinsing, and drying in system comprising:

first station adapted and configured to house the object;

sonicator adapted and configured to impact the object in the first station with ultrasonic energy;

20 liquid transporter adapted and configured to circulate at the first station and around the object wash composition, antimicrobial composition, rinse composition, or to circulate plurality of these compositions; and

dryer adapted and configured to dry the object in the presence of sterilant.

25 114. A method for washing, disinfecting, or sterilizing an object, the method comprising:

contacting the object with wash composition and ultrasonic energy and providing the ultrasonic energy from point source adjacent the object;

treating the object with antimicrobial composition;

rinsing the object with rinse composition;

30 drying the object; and

exposing the object to gaseous sterilant.

115. A method for washing, disinfecting, or sterilizing an object, the method comprising:

contacting the object with wash composition and ultrasonic energy;
applying ultrasonic energy throughout the wash composition;
treating the object with antimicrobial composition;
rinsing the object with rinse composition;
drying the object; and
exposing the object to gaseous sterilant.

116. A method for washing, disinfecting, or sterilizing an object, the method comprising:

applying ultrasonic energy to the object from point source adjacent the object;
contacting the object with wash composition and ultrasonic energy;
applying ultrasonic energy throughout the wash composition;
treating the object with antimicrobial composition;
rinsing the object with rinse composition;
drying the object; and
exposing the object to gaseous sterilant.

117. A method for washing, disinfecting, or sterilizing an object, the method comprising:

applying ultrasonic energy to the object from point source adjacent the object;
contacting the object with wash composition and ultrasonic energy;
applying ultrasonic energy throughout the wash composition;
rinsing the object with first rinse composition;
treating the object with antimicrobial composition;
rinsing the object with second rinse composition;
drying the object; and
exposing the object to gaseous sterilant.

118. A method for washing, disinfecting, or sterilizing an object, the method comprising:

contacting the object with wash composition and emitted energy;

treating the object with antimicrobial composition;

5 rinsing the object with rinse composition;

drying the object; and

exposing the object to gaseous sterilant.

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